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DAIRY OF THE FUTURE

— THEORY AND PRACTICE COMBINED. —

— BY —

A. P. REID M. D. &c.

SUPERINTENDENT OF THE N. S. HOSPITAL FOR INSANE.

*Read before the Nova Scotia Dairyman's Association. Held at
Halifax, N. S., 18th March 1890.*

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DAIRY OF THE FUTURE,
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SUPERINTENDENT OF THE NOVA SCOTIA HOSPITAL FOR INSANE.

Mr. President and Gentlemen of the N. S. Diaryman's Association :

You can imagine an urchin guilty of a misdemeanor and arraigned before the Dominie, who, with uplifted hand is prepared to castigate: Metaphorically I am in the position of the urchin, but, as the Dominie permits the culprit to enter his plea, so I will ask you to accord me the same privilege and withhold the punishment until I have had my say—unless I take too much time in doing it. The crime is the cool assumption that places me where I am with the design to address you on an *art* in which you are professionals and I cannot even claim to be an amateur. Yet I am not wholly to blame, your Secretary, Mr. Black, has much to account for.

I must retract a little, however, as I can recall the time when not much taller than the old dasher churn I unwillingly exercised my muscles on it; but even this thorn had a rose attached—for when the operation was completed I had all the buttermilk I wanted; a delicious drink of which I can scarcely recall but a memory.

Neither have I the honor of being classed as a farmer, the man who may look upon no master except the ruler of the universe—unless he has a mortgage round his neck. Who is courted by the omnipotent politician, at whose nod small fry tremble. The man who is courted—flattered—and often fooled, but yet the only man on the *footstool* that can be *independent of pride, place, or power*.

I am only a public servant and at any ones command, but I have a fair respect of getting experience in farming if knowledge comes with financial expenditure.

As to the Dairy business my interest is that which every one in the community has—to wit: getting first class dairy products at a reasonable rate, and we grumble not so much at the cost as the quality that is offered us.

You can easily conceive a presumptuous person perched owl like on a high pedestal of ignorance and calmly surveying what takes place amongst the

cognoscenti around him—but you can also imagine that as his observation is more or less sharp he can see faults or irregularities that are not perceptible to one in the busy throng of workers who has his attention fixed on an idea he is developing.

You may think it is quite in harmony with my other efforts when I thus claim a point of precedence for ignorance, but I ask you to permit this explanation—a mind without preconceived opinion is remarkably well adapted to carefully weigh any facts presented to it.

The U. S. jury system recognizes this fact, but goes farther than I would for the less the juror knows the more acceptable he is. Correctly speaking the more general knowledge the better, as the mind is better trained for observation, and you will excuse me for laying down this axiom: *Observation and the ability to utilize it is at the foundation of every successful mental or material.* I do not use the term Education and this advisedly, for it may mean everything or practically nothing.

In this running counter to accepted ideas, let me illustrate how ignorance with observation is superior to a narrow education.

An unlettered man made a visit to his city cousin a professor of chemistry in the university, and seeing him very busy he hazarded the question. Sam, what are you doing? Oh it is no use telling you as you could not understand it. However, Sam, let me hear it!

Well, said he, I am experimenting in search of an universal solvent (many men have pursued this *will o the whip* as well as the elixer of life and such like, but since the time of the alchemists more tangible ideas prevail). What do you mean by that? He said some fluid that would dissolve anything. Well, Sam, if you were to get it what would you hold it in? It is needless to say this closed the experiment.

Yet we have an almost universal solvent that the dairyman cannot dispense with, and its purity is of first importance, it is *water*; but this does not disprove the fact that the correct observer is the practical man, farthest ahead in every walk in life.

In order that you and I may get along together harmoniously during our association, let us take the neutral ground of general knowledge and work onward from that.

There are three kinds of applied knowledge:

- 1st. The *Mechanical*, which does not assume mental ability.
- 2nd. The *Artistic*, which includes the former and mental ability as well.
- 3rd. The *Scientific*, which includes the preceeding and with one hand on the known it indicates with the other where the unknown may be discovered.

The first two are those which will chiefly interest us.

Dairying as I understand it, means the methods by which milk is converted into marketable products by (I was going to say) rude appliances and skill, because the different preparations of condensed milk and prepared foods are not generally included under this common term. But, you may also add, it does not include the scientific (?) process of oleomargarine—potato cheese—starch ice cream and bogus butter. Hence, I think, I will have to amend my definition, because we see special skill in cheese factories and creameries, and say, Dairying means the sale or collection and distribution of milk and the manufacture of the milk products of butter and cheese. The more precise and chemical definition would be the fatty and albuminoid constituents of milk, for milk contains more than butter and cheese that is valuable, and which you do not handle.

When a cautious boy is travelling on thin ice he is careful as he proceeds, and in my case this is particularly needed.

WHAT IS MILK?

1st. *Common consent* defines it as a useful, agreeable and desirable product of the Cow.

2nd. The *Physiologist* as a typical food containing all the elements necessary for nutrition in proper relative amount.

3rd. The *Chemists definition*: A compound organic fluid, having a specific gravity of 1026 to 1035, average 1029, and containing the following percentage of constituents: Water 86.8, Fat (cream) 3.7, Albuminoids (casein albumin and lactoprotein, or cheese) 4.0, Carbohydrates (Lactin or Sugar of Milk) 4.8, and Salts (Phosphates Chlorides, Lime, Iron, &c.) 0.7.

But its constitution varies with every animal and the same animal at different periods or with varying food.

Not referring to the deficient cream per centage and increase of water that is very often found in the milk as we see it in cities.

4th. The *Sanitarian* defines it as an organic fluid used as food, very liable to undergo decay, very often a vehicle for disseminating diseases such as Scarlet Fever and Euteric or Typhoid Fever, Tubercle or Consumption and zymotics generally, and requiring careful handling and government inspection.

5th. The *Dairyman's definition*: One of his farm products that he wishes to manufacture and sell for profit.

You will thus perceive that there are five different ways of defining this material, each interesting, nay more necessary to be known, but your time and my ability must greatly abbreviate its description. It will be more appropriate for this occasion if we consider it from the Dairyman's standpoint, and since you do not require me, and I would not attempt to discuss the ordinary practical details of the dairy, we will direct our combined attention to the industrial aspect of the question in which others as well as Dairymen take interest and to the physical and chemical properties of milk, as with these I am best acquainted.

There is a trite saying that "Farming don't pay," and a large number, with as good reason and truth, say "Dairying don't pay as it should," and as I understand it your business here is to discuss this question, and if there be failure to evolve success by finding out wherein the failure obtains.

A business man, on enquiring into existing farm methods would be astonished if they did pay, for I think this fact cannot be disproved. That superior dairy products are difficult to obtain and as well costly, and inferior ones, are to be had everywhere at a price which is even more than they are worth but not enough to pay the producer, coupled with this undoubted fact, that *it is just as expensive to make a poor article as a good one*, to turn out rancid grease as gilt edge dairy butter. Let me emphasize this fact. The expense to the dairyman of poor butter is the same as that of the best article. This is not business and failure must follow the conducting of such an enterprise.

And "*why is this thus?*" You have all the mechanical skill and appliances needed. But have you a practical educational training and a thorough knowledge of the physical and chemical properties of the material you handle? I fear this information is not very largely or widely distributed.

You may say it is very easy to find fault, can you correct it?

My answer must be, until you localise the fault you cannot correct it.

I fear I must pose in the disagreeable position of fault finder.

Stabling a horse in the parlor may not be *apropos*, but if one were to be so located when the owner of the parlor got him ejected, and his excusable anger cooled down and he came to take stock of the damage, it may not have

been altogether an unfortunate visit, or in other words the untimely call may enable him to ward off a greater injury. The broken floor may disclose a rot or defect in the beams supporting it, or a defective foundation that was not known, and which being concealed, might continue until the defect had gone far beyond easy repair.

The horse may have also disclosed other weaknesses that a careful owner would desire to have strengthened, and on summing up he might conclude that matters might have been worse.

I am a trespasser in the Dairyman's Sanctum and stamping round may disclose defects in the foundation that he does not correctly appreciate.

Firstly (and if I do not get as far as secondly rest thankful) we will consider the butter making process.

How much real knowledge is possessed on this subject? *History* is silent as to when the discovery was made that "if milk be allowed to stand the cream will collect on the surface" and as well when some nomad put his milk into a skin, and tying it behind him on the saddle he discovered at the end of his journey that the cream had collected into a lump, beyond this how far we have you reached, except in a few commonplace details. Yes, there are two recent discoveries and these will be referred to shortly.

How many of those engaged in dairying can give any reason for their practice other than that it is the correct thing to do or "I was taught to do so by those that knew." If all the operators were agreed on a certain line of practice, no doubt it is the correct thing even if it cannot be explained for practice is generally ahead of theory in the race for success.

But are they all agreed? Let us for illustration's sake assume that I am not going into the buttermaking business and make my intention known, with a desire for attaining perfection.

I go to acknowledged experts in the art, and with what success? One says let the cows have grass only if you want flavor, color, &c., another says also roots, or meal, or bran, the quantity will increase and everything be all right. But few agree as to the best method of feeding silage, bran, meal, or mix grain.

We will, however, assume that the milk is obtained, a good buttermaker tells me to use shallow pans for every desirable perfection, and another peculiar pool's that idea and recommends "deep setting." There are a half dozen varieties of creamers all different in structure and principle and each one the "ne plus ultra."

There is no fixed rule as to the temperature and length of time the milk should stand before skimming, nor how long the cream should stand after skimming and before churning. One wants it pretty well soured or the ripened—correct term would be decomposed, or more or less on the way to rottenness; another mixes old and new cream; another tries to hit the mean between extremes.

When we get the churn a score of varieties are presented, that I would fail in attempting to describe. One pumps air into the churn while churning; another keeps the air out very effectually; one puts hot, and another of puts cold water into the churn; others put either on the outside, an old hand claims that the old way is best.

One uses a thermometer rarely correct and not unfrequently broken, another uses the finger for a gauge. Something like the West India negro engineer, who, when asked if steam were up, wetted his finger in his mouth and passed his hand over the outside of the boiler and said *No Sir*. Why how do you know? "Well, you see, when steam is up it is hot and sizzles." The want of gauge glasses and safety valves were not missed by that engineer, but an error in judgment might make him missed at any time.

There is not the same prospective danger from an error in judgment or want of dairy gauges. The churn manipulations before and after the butter comes, and its preparation for market are processes on which authorities likewise do not agree, and yet there is not one of my advisers who may not be able to give me a theory for his recommendations and point to the product resulting as proof. Is it any wonder that we have so many different products from the same substance and going under the same name, many different kinds of butter—stamping round mostly bad.

For the past twelve years I have been officially an examiner of this product, and am sorry to have to say the samples I have to deal with are fair, middling, indifferent and bad.

It need not be so. I once tasted butter that had been round Cape Horn and twice crossed the equator and Pacific Ocean and finally was carried 1000 miles inland, the last 300 on a mules back in a keg exposed to the sun, and when opened I was astonished at its flavor and delicacy, not less than three years after it had left the dairymen's hand (it cost \$3 a pound). But to reach this how near to my butter making enterprise. With an experience as related what conclusion would any one arrive at who had been trained to believe in the intimate relation between cause and effect. Would he not say? Gentlemen, I was taught to doubt must be all wrong; there may be some relation between your process and on a certain line, but, there is nothing definite or tangible.

Before putting out money into this enterprise, enquiry by experiment had better be made, and the subject must be systematically studied so as to get near as may be a better knowledge of the natural and physical characters of milk, for these must control the processes that are successful.

On
, &c., another say.
everything be al

WE WILL BEGIN WITH THE MILK.

This complex fluid contains a lot of microscopic fat globules that do not together when brought in contact, and why is this?

Is it because each particle of fat is in a little cell or bladder and they cannot touch each other, or are they simply floating in a fluid that has the peculiar property of keeping them apart,—as oil has on quicksilver? For if they be shaken up together, the mercury will be divided up into globules or particles and these will continue to be kept from adhering to one another in the presence of the oil. Which is the correct theory?

The first has had most supporters, and would explain why when cream is ripened (decomposed) the little bladders have rotted and being easily torn the churning brings the fat globules together and we have butter. This is a very easily understood theory, its only fault as far as I can make out is that it is not true. Because:

1st. No one (and many a sharp eye has looked for them) has ever seen any trace of the little bladders or cells.

2nd. If "ripening" destroyed them, why do not all the little particles of fat unite together and give us a product like lard (we can get this and I will explain how)?

3rd. If the little bladder cells keep the globules apart, then butter should not be obtained until they are destroyed and this is not the fact, you can get butter from perfectly sweet and fresh milk by mechanical methods (but more labour is required) and if this be continued the butter fat may be obtained in a physical condition like lard.

The second theory explains all the conditions and must be correct, the so-called ripening process simply destroys by decomposition the physical properties of the fluid, the globules or particles float in and makes it easier to

unite them by agitation or churning, but by a simple mechanical process they can be just as perfectly agglomerated into the product we call butter.

This simple study of some of the physical characters of milk explodes a lot of theories previously referred to.

Butter fat is lighter than water, and skim milk has a specific gravity less than 1030, or a vessel holding 1000 ounces of water would hold 1030 of the milk or it has so much more floating power than water, hence the fat will rise to the top if it can, but it has adherent to it a viscous, sticky, or thin jelly like fluid that keeps it from rising when it is so finely divided up in this fluid. As in the motes in the sunbeam which, though so much heavier than the air they are suspended in, yet take some time to fall owing to the viscosity, or we may say stickiness of the air which increases the friction when the particles are in motion. (The hypothetically perfect fluid would have no friction; the only way it would permit a body to pass through it without sticking to it or hindering it, but such an one does not exist.)

However the motes will fall and the cream will rise, if kept free from motion or agitation in their enveloping fluid.

Knowing these properties of milk, we can, by calling to our aid another natural law, assist the separation by the difference of the specific gravities of the fat or cream and the skim milk, this brings me to the first of the discoveries of recent date, that has been referred to.

To explain, if bodies be put in motion and kept moving the speed and distance of their travel is proportional to their size and weight or specific gravity. To farther illustrate, suppose you take a leaden and wooden ball and throw them both from the hand at the same time and with the same force, the leaden ball will go farther and faster than the other and the wooden one will lag behind, being of less specific gravity.

If the leaden ball be very small its speed will be proportionally less, but the greater the speed of their travel the more would the small one get ahead of the larger, so that with sufficient speed an infinitely small leaden ball would still keep farther way than the wooden one.

How can this law be applied to milk? It can be accomplished by the centrifugal machine or separator.

Put milk into a vessel and cause the circumference of this vessel to travel at a speed of over a mile a minute, or from 1200 to 2000 revolutions a minute in a vessel 18 inches in diameter. The fluid of the milk is heaviest and for a distance of its viscosity travels farther and faster towards the circumference, while the cream, or fat, lags behind or is pushed inwards out of the way of the fluid on its travel to the circumference. Very soon the cream forms a layer on the inner side of the mass of milk in the rotating vessel and by proper appliances can be readily removed.

This explodes all the theories about milk setting deep and shallow, or a hot and cold surroundings, at least as far as the handling of any quantity of milk is concerned.

Hence we may in the dairy of the future have the cream perfectly pure and sweet, and not necessarily a half hour from the cow.

Next we will enquire into the second of the late discoveries—the getting of the butter.

The separator cream has had the fluid of the milk so well removed from between the little globules of fat that by removing it a little more they can come together as much as we want them to, for as you are aware, if they were brought perfectly in contact the butter would lose its granularity—one of the special points in choice butter—and become as it is termed greasy or lard-like.

mechanical process we call butter. Oleomargarine can be made granular without the presence of milk in any form by a peculiar method of working it and at a certain temperature.

This second discovery then is that a very simple piece of apparatus added to a separator that is driven at a little greater speed than the ordinary separator drives away more of the milk and the fat globules agglomerate into but-
old 1030 of the miller instead of cream as in the ordinary separator; and butter forms in the
the fat will rise to the apparatus.

Even ordinary separator cream can be churned directly in a churn with
up in this fluid. A similar result. This fact explodes the balance of the theories about ripening
er than the air the cream, &c., as being necessary for the formation of butter, it may be con-
the viscosity, or venient as butter is now made, but it also fixes the germ of decay in the but-
n when the particles in such a way as to render it very difficult of removal and the keeping of
have no friction; the butter is imperilled.

Hence it is not only possible but practicable to take the milk fresh from
the cow, put it through an apparatus or machine and in less than an hour
e, if kept free from all the butter fat separated as sweet butter and the skim milk as sweet
and fresh milk.

This will be the perfect and cheap system of manufacture in the dairy
the specific gravities of the future.

But an advance of this kind must be opposed. Our conservative butter
friends hold up their hands at once in warning—"it will never do, it will not
deep, you cannot get the flavor, &c." In the latter assertion I agree with
them, but would go further and say, I don't want a so-called ripened (decom-
den ball and throspose) flavor.

Since the milk constituents, that are so very liable to decay, are very
the wooden one with thoroughly removed, the butter should not acquire a rancid flavor, for pure
fat carefully kept is little likely to change in flavor or taste; as for instance
proportionally less, but good salad (olive) oil will keep indefinitely.

But to the test. You have no doubt seen as well as I have in a late
small one get ahead. In an agricultural paper, that two samples of butter were made from the same
y small leaden agricultural paper, that two samples of butter were made from the same
sample of milk, the one in the old way and the other (sweet cream butter)
accomplished by the made from the sweet separator cream; these were sent, with a private mark
on each, to a distant experimental agricultural station for an opinion on their
relative merits. The answer came back "very good samples, not much dif-
ferences a minute difference, if anything 'No. 1' was superior"; this was the old process sample.
heaviest and for a After keeping three months, the answer came "no appreciable difference, both
inference, while the good." After six months, "both good, but 'No. 0' superior"; this was the
way of the fluid new process sample.

This result might have been anticipated, we know butter can be made
ms a layer on the by proper appliances to keep very well by ordinary process, but would expect to have superior re-
sults in keeping qualities from the new process. Then again, our tastes are
deep and shallow, so accustomed to the stronger variety of flavor that a new and more delicate
of any quantity one is not at first appreciated.

If I may illustrate. I was seated one day in a restaurant in Paris with
eam perfectly pure the "vin ordinaire" on the table, a fluid not more intoxicating than sweet
cider. The waiter pointing to the table wine whispered to me asking me if
veries—the getting I would not have something stronger, I expressed my satisfaction with what
was present, as I did not use strong liquors. He asked me if I were English
well removed from (this phrase is used in a generic sense) I said I was. Well, said he, I don't
ttle more they can understand you, all the Englishmen I meet want something stronger than
are aware, if they our ordinary wine.

I doubt not most palates are so used to something strong in the way of
granularity—one termed greasy or butter, that the more delicate article may not at first be appreciated.

In looking around me if I mistake not there are enquiries to this effect.

"Oh, this is all very good, but what has this to do with our every day dairy work; who is to get it, or who is to be able to run this proposed system?"

For answer, let me say your previous practice has been indefinite and you have been working in the dark.

If I have made clear to you two points, first, what is wanted and second, how it is best obtained, what you do not want in butter except the pure fat, and how to get it, why your ordinary product is so liable to decay and how to prevent it, doing away with all false theories, and giving you a sound basis for your practice, if I have made these points clear, then my effort has not been wasted.

THE DAIRY OF THE FUTURE.

Commercial success can only be obtained by the adoption of correct commercial methods. Is it probable that any business would prosper if managed by those without business experience, or manufacturing concerns flourish for any length of time if their products were inferior, unreliable, and would not endure honest service for a reasonable time?

The only way we can judge of the future is by the past, and judging the past, if old methods obtain, neither farming nor dairying will pay.

Hitherto you have been depending on monopoly, believing that your products can not be dispensed with, but this antiquated as well as unworthy crutch has been rather rudely snatched away.

The chemist analyzed butter and found that a good article was chiefly composed of olein and margarine fats and so small an amount of Butyrin, or to the flavoring principle of butter, that an artificial article could be easily prepared. Suet or tallow is a regular and good article of food, it contains Stearin (a very hard fat) in addition to olein and margarine. Stearin is a very valuable article of commerce for candle making, and the presence of the two softer fats decidedly objectionable for this purpose. Stearin can be removed from tallow, because pressure at a certain temperature expels the more easily melted fats.

The oleomargarine can be granulated at a certain temperature by mechanical methods. At no time is there any chemical or other influence brought to bear on the tallow to injure it as a dietetic; the processes undergone are not unlike those used in obtaining butter from milk. The result was a foregone conclusion, the oleomargarine was churned with milk to flavor it and " presto " we had imitation butter or " Oleo " as it is often called; the better term would be Margarine, as this fat is present in largest quantity.

There is this difference between the products, genuine butter as generally met with soon gets rancid and is unsaleable as a food, but the artificial, being carefully prepared, will keep well, and this particularly in warm climates where it sells for a higher price than ordinary butter. If properly prepared it should be a perfectly healthy and palatable food and should not be sold under any false name.

But there is a heavy black line of falsehood running through the pages of human character.

No sooner did oleomargarine get its recognised place—large sale—an opportunity become a remunerative business, than it was adulterated by admixture with and even replaced by impure fats and tallows chemically manipulated, and our good legitimate business became a fraud.

Farmers had influence to hamper the business, and though they were justified in preventing fraud in manufacture or name, I fear they were also deterred by jealousy of its competition with butter.

However, all may rest assured that if the grade of butter in general use

to with our every does not become superior to that of "oleo" then butter must drop. The this proposed system statute book cannot control commerce as we find it to-day. as been indefinite and

With the dairy of the future "oleo" will scarcely compete.

what is wanted and himself alone, though the substitute is far inferior compared with cheese in butter except than an "oleo" is compared with butter. Potato cheese, in which cotton seed is so liable to decay and potatoes with skim milk are component ingredients has been able to es, and giving you aim for itself a place in trade. I might go farther, but have said enough to clear, then my effort few you that the dairyman has a competition he cannot ignore, and the dairy the future can not be that of the past if its owner expects to make a wing by it.

The ordinary farmer has also competition in other ways, but it is a little foreign to my present subject, and time is too limited to take it up, in either option of correct con se there must be a change of base to meet a changed competition. d prosper if manage

concerns flourish f Is the future then dark? By no means, I can see ahead a brightness at has never yet shone on you. The drudgery will give way to intelligence and mechanical power and will be compared with the old as reaping a liable, and would no field of grain with the sickle or cradle can be compared to harvesting with self binding reaper.

past, and judging held of grain with the sickle or cradle can be compared to harvesting with self binding reaper. y will pay. The farmer does not now think of carding his wool, or spinning, or weaving that your pro as well as unworthy by hand, as it pays better to sell to the manufacturer.

His grain is threshed and ground by power, and so I might go on and d article was chiefly the gradual change which has been accomplished to his comfort as well out of Butyrin, as to the benefit of his pocket.

could be easily pr Dairy products must be handled in the same way. Capital, Skill and of food, it contains machinery are needed to run a modern business with profit as well as satisfaction. Stearin is action. As to details, I will merely attempt outlines.

and the presence of You must have *Capital, Technical as well as Theoretical Skill and business*. Stearin can less or managing capacity with modern machinery.

temperature expels th How are these to be obtained? Experience has dissipated a fond delusion I had in the efficiency of stock companies. The capital is apt to be temperature by mented and as well uselessly dissipated by want of skill in the directorate or other influence, or the promoters—technical ability is too apt to be measured by the the processes under number of friends the applicant may have on the board of directors, and the n milk. The result management or business head of the concern is likely to be similarly influenced. d with milk to flavor Until a riper experience modifies present impressions, I should feel more it is often called; he favoring the erection of dairy manufacturing concerns by assisting some largest quantity. person who assumes the risk of loss with the duty of managing, and as well e butter as generally manufacturing profit to go to him if he be successful. The business may the artificial, being started by the toll system, the farmer giving a per centage of his raw in warm climates material for the manufacture of the balance. He thus becomes his own merchant properly prepared paying in kind for the conversion of his milk into the more marketable should not be sold products.

Or, a bonus may be given to entice the manufacturer, but in any case g through the page must be a guarantee fairly carried out by either party. The farmer hall furnish a given quantity and quality of milk and the manufacturer be in ce—large sale—an position to handle all he contracts for and furnish a satisfactory product. by admixture with This is a business, or commercial affair, subject to the laws of trade and manipulated, and commerce that we need not here discuss, but, I think, the greatest success as attended the systems of manufacturing on toll and on direct money payd though they were not, and the greatest failures where some one starts a factory and begins fear they were also do well then another starts in the vicinity which can only support one and oth fail, and this the more if the opposition be a joint stock concern in haste utter in general use get rich, but wealth only comes to industry skillfully conducted.

The preceeding remarks refer to the more extensive dairy operations which can be carried on in the more favored localities, but there will always be some so situated that it will not be practicable for them to carry out the modern system thus projected, and you can with propriety ask me if there are no suggestions to meet such cases to the end that dairying be more profitable and the product less liable to deterioration.

Though I would not think of giving any recommendations as to any specific practice, yet it may be in place for me to offer such information as can be derived from a study of the chemistry of milk and butter, and thus with your permission, I will offer in such a way—as far as I am able,—as to be utilized in the ordinary dairy operations of the farmer's home.

Milk is a fluid having an alkaline reaction (as distinguished from an acid or having a sour taste) and commences to decay as soon as it leaves the udder (for, as you are aware, nature's design was for its immediate use in nourishing the calf).

This change, or decay, is measured to a great extent by the temperature—the lower the temperature the less the change, and vice versa up to 110° at atmospheric conditions also have a very marked influence.

The casein, or what forms curd, is an albuminoid or nitrogenous substance and like all those compounds very prone to decay. It is not soluble in milk acid fluid, as every dairyman knows vinegar or an acid will at once turn milk curd. Under ordinary conditions the lactic acid or milk sugar (owing likely to its contact with the albuminoids present, of which casein is only one) begins to decay and is converted into lactic acid.

Until the acidity, or sourness, has increased sufficiently (to neutralize the alkalinity) the milk remains fluid, but as the acidity increases we have first a curdling or coagulation, and then a further acidity until the milk becomes quite acid—sour milk. The curd also decays and we may in a short time have a very offensive compound.

Casein is coagulated by the addition of many other things as well as acids, but under ordinary conditions lactic acid is the agent. By adding soda or an alkali the curdling can be delayed for a time, because the acid condition is by this means obviated.

The above properties of milk must be borne in mind when considering the subject of butter preservation no matter how obtained, for the influence of adherent milk contamination does not appear to be clearly understood.

In any organic liquid it is difficult to prevent (and almost impossible to arrest) decay when it has once begun, and in buttermaking when souring or ripening has been established, very, very great care is needed to prevent the changes being conveyed to the Butyrin or volatile flavoring fat of butter than if it were obtained in the direct mechanical way and where no chemical change has occurred, as in commencing decomposition or ripening.

The volatile fats are far more delicate compounds than the fixed fats and are the first to break up when exposed to deleterious influences.

Though ripening assists in separating the butter fat from the milk, and I have no experience that would counsel my recommending any other plan under the ordinary conditions of the dairy, yet you must not be oblivious of the fact that it adds an additional element of danger to its keeping qualities.

All ordinary butter starts with the seeds of decay firmly attached to it and no preservative—such as salt—is sufficient to arrest it, and this the more when exposed to a warm temperature and more or less to the air as well.

How is the ordinary buttermaker to deal with things as they are presented to him? Theoretically if all the other substances in milk could be removed from the butter, no matter how obtained, and the fat left pure and

extensive dairy operation, but there will always be free from contaminating material, then it would be incapable of easy removal. Practically how is this to be carried out. Before giving suggestions let us examine as carefully as may be what is to be done. Before giving suggestions let us examine as carefully as may be what is to be done.

Take a sample of ordinary butter as it comes from the churn, there is a large amount of butter milk which imparts a flavor, it is then removed until it is assumed the milk is removed, then salted and put away for use. and butter, and then.

What does butter in its finished state contain? Water is present in 5 to 10 per cent. of best genuine butter, but the fresh article often has 15 to 20 per cent., and in some salted specimens as high as 28 per cent. has been found. Casein, or curd, is always present, the best butter containing the least—3 to 5 per cent.

Of fats there are from 86 to 96 per cent. They are volatile and non-volatile, the former give the flavor, they are Butyric, Capric, Caprylic and stearic Acids united with the glycerine base.

The non-volatile forming the chief bulk of butter are the oleic, margaric, myristic and stearic acids with glycerine. The volatile fats when chemically mixed by decay split up into the volatile acids and give the rancid flavors. In order that any of you may form a good practical idea of what your butter consists, in fact a chemical analysis that each of you should habitually make when engaged in dairy work, the following simple process will give the fullest information.

Take the sample of butter, melt it at a low temperature in a test tube by being dipped into water warm enough to melt the sample (a long narrow glass vial or bottle will do), when melted put your sample aside in a cool and not too cold a place, because too sudden cooling would not permit the substances in butter to arrange themselves according to their specific gravities.

When cold, examine it, and you will find the mixed butter fats on top and below the casein, (or butter milk) and water containing the salt. Some altered commercial samples contain much more variety than this. You will be astonished to see what a large per cent. of so called butter is not better even in good samples.

The specially obnoxious substance is the casein, which, in inferior samples, will form comparatively a large bulk. As before intimated this substance had begun to decay before churning, and this that remains will go on in its course of decay and drag the volatile fats along with it to their destruction.

When casein is present in any quantity there is no known practicable means that will arrest its decay, or that of any of the albuminoids when decay has set in—it even requires skill to preserve fresh samples.

Evidently then the aim of the butter maker is easily to be discerned, should remove all this injurious material that is possible and he should get it down as low as 3 to 5 per cent. In testing, if he weighs his sample and collects and dries the Curd and weighs it, he could be precise and accurate. frequent testing will enable a good working estimate of the quantity present without weighing.

How is the removal of this casein or so called butter milk to be affected? Washing is the ordinary means adopted, and it is in this where skill is displayed, by washing and washing the entangled milk is removed, but the butter is apt to lose its granularity and become greasy.

Skillful manipulation does not necessarily injure the texture.

In this field there is room for a large amount of experiment, not even a butter working machine is perfect in results.

I can only suggest experiment and testing the product. The test is easily applied as before referred to, put a sample in your testing tube or bowl, put this into warm water until melted, let it then stand aside until cold, the process which gives the least Curd or Casein is the best one, the water should not be over 5 or 10 per cent. It will not be difficult for an intelligent operator, by frequent and careful testing, to attain all possible perfection. Water for dairy purposes should be exceptionally pure—avoid any well that is near a house or stable, or any water having taste or odour. Some use brine instead of plain water and it may have advantages as any fluid left in the interstices of the butter will act as a preservative.

I would suggest a mild alkaline fluid in preference, as it has the power to dissolve casein and thus facilitate its removal, and there is none more likely than Borax water to carry out the suggestion. Borax is not very soluble in water (requiring a pint to dissolve a little over an ounce of it, or $1\frac{1}{2}$ gallons of water per pound of the salt). It dissolves Casein, is a better preservative than salt, has no disagreeable taste, is not injurious to health, can be washed nearly all away and any that may be left will be of advantage as a preservative.

Hence I would suggest the following as an experiment for any of you to try and report the result to this Association.

Use plain water at first until the milk is apparently removed, then the Borax water quite freely before salting in the usual way. But practice and the test tube are the only safe guides.

Many dairymen appear to forget that fresh butter will at once absorb any odor or smell that may be in the air in its immediate vicinity, and that they are not careful enough in keeping it away from cellars or milk houses that have a musty smell, no matter how clean they may be otherwise.

This property of fresh butter could be utilized in giving any wished flavor, but I am not aware that it has ever been used. This is on the principle of *enfleurage*, now so largely used to absorb the very delicate flavors of flowers that can in no other way be collected and retained.

A few rose leaves, or other desirable flavoring, laid for a few hours in fresh butter would give it a delicate aroma of rose or the other flavor. This might be desirable to try this experiment.

I must, however, in truth state that there are many samples of butter in which the effort has not been how to make a good article, but how to make it bulky and heavy. It is not unfrequently made to carry all the water and butter milk it can hold, which may by manipulating amount to as much as one third its bulk, and to further increase its weight coarse salt is added. My teeth have often been brought to the test of their strength in cracking chunks of salt in butter.

In fine the ordinary butter making process can be greatly improved by the experiment as above suggested and be a boon to the dairyman as well as to the customers pending the more perfect manufacture which has been outlined.

But I fear I have taken up too much of your time and will not go on to *secondly*.

Of the five different views that may be taken of milk, I have but rapidly glanced at one of the many headings in one of the five views referred to.

The feeding, the housing, and the health of cows, would require careful consideration.

Another milk product

CHEESE.

Cheese can be but mentioned.

Another of its products, even greater in weight than either butter or cheese, is so totally ignored that I have been surprised cheese makers have not attracted attention to it.

LACTIN OR SUGAR OF MILK.

I refer to the *Sugar of Milk* that now decomposes and becomes offensive and the factories and is wasted or so fed to hogs as to be of little account. In the skim milk it is used up in course feeding, but *lactin* is a most delicate article of sugar, that which gives to fresh milk its sweetness and only wants to be generally known to be appreciated. It is a costly substance now as it is little used that only druggists keep it and not many of them. Switzerland furnishes most that is found in commerce. It is easily made by concentrating sweet whey until the sugar crystallizes out. I need not go into the details at present. *Lactin* is not so sweet as cane sugar and has never been used in quantity in the pure state, but will be made and used before long. It will pay large dividends. Swedish chemists have of late made a detailed preparation of skim milk. It is used for several purposes, as a food, and roasted and ground as a beverage, with coffee, &c.

CONDENSED MILK.

Vacuum process milk is another product. As we find it it is an inferior preparation containing from $\frac{1}{6}$ to $\frac{1}{3}$ of water and as well loaded as high as 10 per cent. with cane sugar.

It also requires costly packages for transit.

These disadvantages must necessarily accompany the handling of milk as it is at present utilized, because if all the water be removed a compound results containing fat, which is very liable in this form to decay and the addition of water fails to restore it to its pristine condition of milk. A part of the water being retained the sugar is added as the most harmless, agreeable and nutritious preservative.

By scientific reasoning, or from the *known* to deduce the *unknown*, I would hazard the prophecy that it is more than probable that by removing the fat or cream from the pure and fresh milk, the remaining casein, lactin and salts can be desiccated by the vacuum process, and the addition of water to this powder will restore to it the original properties of the milk. The fat, butter having all foreign matters removed will not be liable to become rancid and can be put up so as to retain its freshness and flavor. In place of one we will have two products that can be mingled in any desired proportion and a pure and good milk be at our command at any time and in any place without added sugar. This addition is an inconvenience for many purposes, it increases the cost and as far as children's health is concerned it is not desirable.

Thus the public will have the sanitary, and the dairyman the financial advantage. The term sanitary needs further explanation.

The less chemical changes milk is subjected to the better it is as a food, even simple boiling lowers its digestibility and value, in the vacuum process the high temperature of boiling is avoided.

Addition to milk is not necessarily improvement. Sugar would be considered a harmless union, yet it has been found that children fed on the best condensed, or sugar preserved milk, apparently thrive and become fat and

healthy looking. Yet they are more liable to disease, and when attacked by a malady do not recover as readily—they have not the same vital strength as those who are brought up on pure milk. Milk is a perfect food in the natural proportion of its constituents, and an added increment of sugar may fatten, but does not proportionally build up the tissues. Yet to the city child canned milk is a boon, and for superior with all its defects to the inferior milk too often disposed of in cities.

THE CONCENTRATED MILKS

Those having from $\frac{1}{2}$ to $\frac{3}{4}$ the water removed are good preparations, but will not keep long and the manufacture and packages for transport are too costly to permit the sale at low enough price for general use.

Milk in its natural condition can be canned and by alternate boiling and cooling be kept from decomposing, but it has the same objection as the preceding and a relative indigestibility from repeated boilings.

There is much more that might be said on this subject, but time does not permit.

In looking back over the debris of exploded dairy and butter making theories, I must not forget that they deserve an honored place as the record of advancing human intelligence.

The future is illumined by hope and good prospects, but you stand only on the threshold of your anticipations, and courage as well as faith is needed for success.

However, allow me to thank you for so kindly listening to a discussive paper, and though I have been taking up your time with things I assumed I knew a little about, yet it would take an infinitely larger paper to tell you things I am certain I know nothing of, and which would be equally interesting and profitable to you, and which being your object to have you will obtain. You may, however, rest assured that "rule of thumb" process cannot succeed in the face of active competition and the book or theoretical dairyman will be equally a failure.

Theory must be learned in conjunction with technical and practical education, and the experimental farm and dairy must be a portion of the school which will turn out operators who will make the *dairy of the future* a pleasure and profit to the combined manufacturers and producers. Oleo, Butterine, &c., will be located on a lower though not less useful plane when made under stringent regulations as to purity.

While the people at large will I trust be able to get good milk as they can get good sugar, and mayhap in a similar form, and as well become familiar with *Gilt Edge Butter* at a low and remunerative price to producers. This will tickle palates that have never enjoyed these agreeable sensations.

